UNITED STATES DISTRICT COURT

FOR THE NORTHERN DISTRICT OF CALIFORNIA

OAKLAND DIVISION

EPIC GAMES, INC.,	) Case No. 4:20-cv-05640-YGR-TSH
	)
Plaintiff, Counter-defendant,	) **WRITTEN DIRECT TESTIMONY**
	) **OF DR. SUSAN ATHEY**
v.	)
	) The Honorable Yvonne Gonzalez Rogers
APPLE INC.,	)
	) Trial: May 3, 2021
Defendant, Counterclaimant.	)
	) **Ex. Expert 4**

I.   Assignment

1.   I have been asked by Epic Games, Inc. ("Epic"), to analyze whether Apple Inc.'s ("Apple's") conduct affects competition faced by Apple's smartphone operating system ("OS")—and specifically, to consider how it affects switching and related costs faced by users and developers of iOS apps.

2.   In formulating the opinions set forth herein, I have relied on facts and data of a type that I routinely use in conducting economic analyses and that are reasonably relied upon by experts in my field.

II.   Qualifications

3.   I am the Economics of Technology Professor at Stanford's Graduate School of Business. I hold a B.A. in Economics, Computer Science, and Mathematics from Duke University, and an Economics Ph.D. from Stanford University. I have been a professor of economics at academic institutions since 1995, including Harvard University and Massachusetts Institute of Technology.

4.   I conduct research and have published numerous articles in leading peer-reviewed journals on industrial organization, the economics of digitization, marketplace design, and the intersection of machine learning and econometrics.

5.   I advise several firms operating in multi-sided and digital markets and served as consulting chief economist at Microsoft for several years. I serve on several boards, including for Expedia, Lending Club, Rover, Turo, and Ripple, as well as non-profit Innovations for Poverty Action.

6.   I have presented to competition regulators in the U.S., Europe, Australia, and other jurisdictions on issues related to platform competition. I have also been retained by the Federal Trade Commission and the U.S. Department of Justice as an economic expert witness in both merger and conduct competition matters.

III.   Summary of Opinions

7.   Competition in the market for mobile platforms is influenced by "indirect network effects", whereby consumers value OSs that provide access to a large number and variety of applications ("apps"), while developers of apps are drawn to OSs that allow them to reach a large user base. (pg. 3)

8.   Most users already own a smartphone and use numerous apps. Consequently, users are often "locked-in" to a specific smartphone OS because of the costs associated with changing OSs, including two app-related costs. First, a user leaving one platform and joining another faces app-related switching costs, including the costs of re-purchasing apps and in-app purchases

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that cannot be migrated, and of migrating and synchronizing apps and app data when possible. These switching costs create what I call the "App Barrier to Switching." Second, users incur what I call "mixing-and-matching costs" in accessing and collaborating on apps across different platforms, whether among their own personal devices or the devices of members of a group such as a family or organization. For example, family members often share subscriptions to apps or collaborate using apps, such as to share photos or messages. When such sharing is not possible across different platforms, family members may face costs associated with introducing a different platform into the family. For example, parents owning iPhones could be deterred by these costs from purchasing Android devices for their children. These costs create what I call the "App Barrier to Mixing and Matching." (pg. 3-5)

9.   User switching and mixing-and-matching costs reduce competition between mobile platforms, thus allowing platforms to exert market power over their "locked-in" user base and, consequently, over developers seeking to reach that user base. (pg. 5-6)

10.   Developers incur costs of creating, maintaining, and improving apps for multiple OSs (often referred to as "multi-homing"). Multi-homing costs are worthwhile only if the OS's user base is large enough to justify them. This produces a chicken-and-egg problem for new OSs which, unable to attract enough developers or users, face a substantial "App Barrier to Entry," further allowing incumbent platforms to maintain their market power over users and developers. (pg. 6-7)

11.   Middleware such as multi-platform app stores can reduce user switching and mixing-and-matching costs, facilitate developers' cross-platform support for users who switch or mix-and-match, and reduce developer multi-homing costs. For example, a multi-platform app store can provide developers with technologies like user account management systems that can recognize a user's apps, purchases, and app data across platforms. Importantly, a multi-platform app store can coordinate these services for many developers at once so that users can easily migrate and synchronize a collection of apps when they switch or mix-and-match, which is not possible today. (pg. 8-9)

12.   By providing developers with technologies for user account management, payments, streaming, and other services that work across platforms, middleware can also reduce the cost to developers of porting and multi-homing. Because middleware initially operates on existing platforms, it does not have to overcome the full chicken-and-egg problem that new mobile platforms face. In that way, middleware is both a nascent competitive threat in the marketplace for app distribution and can enable nascent competitive threats to emerge in the market for smartphone platforms by connecting new mobile platforms to existing user bases. (pg. 8-9)

13.   Apple's restrictions foreclose app stores on iOS and, consequently, multi-platform app stores available across iOS and Android. Similarly, Apple's requirement that iOS apps exclusively use Apple's own in-app payment system for in-app purchases ("IAP") increases user switching and mixing-and-matching costs and makes it more difficult for developers to offer cross-platform services that would reduce these costs. A cross-platform in-app payment service would make it easier for developers to offer such services. (pg. 9-13)

14.   App-streaming platforms are another form of middleware that could ultimately serve as an alternative multi-platform app store. Streaming could allow users to access multiple apps across platforms and devices, without duplicative downloading or cumbersome management of purchases and subscriptions across platforms. For developers, a streaming platform could reduce multi-homing costs. Apple, however, prevents app-streaming platforms from becoming effective storefronts on iOS and, consequently, from becoming multi-platform app stores. (pg. 13)

15.   Absent Apple's restrictions, middleware would have the potential to: (1) mitigate Apple's market power over users and developers, (2) increase competition among mobile platforms on both quality and price, and (3) increase the chance that mobile platform competitors could enter and/or gain traction (e.g., enable nascent competitive threats). We would expect enhanced competition to foster greater innovation in middleware, including developer services for app distribution, payments, and streaming; increased innovation in smartphone OSs, hardware, and apps; and increased innovation in adjacent markets that contribute to cross-platform and cross-device experiences for users. The welfare benefits of these innovations would accrue to participants both inside and outside of Apple's platform. (pg. 14)

IV.   The Economic Impact of Middleware on Mobile Platform Competition

A.   Mobile platforms experience indirect network effects

16.   Mobile platforms are smartphone and tablet OSs that connect users with app developers. Users purchase a general-purpose mobile device that is supported by an OS platform.

17.   Today, the market for mobile platforms is a duopoly, with Apple and Android together accounting for almost 100% of mobile smartphone revenue share outside of China.

18.   In general, the greater the number and variety of apps available on a mobile platform, the greater the utility for users. When choosing between two mobile platforms, users typically compare the utility, or benefit, that they expect to derive from the apps available on each platform. If a mobile platform does not offer the apps a user requires, the user's utility diminishes.

19.   Thus, mobile platforms experience indirect network effects: the more apps available on the platform, the greater the utility for users; the more users affiliate with the platform, the greater the draw for developers to invest in additional and more varied apps.

B.   Users face app-related switching and mixing-and-matching costs

20.   If a user decides to switch mobile platforms when purchasing a new mobile device, she faces switching costs in doing so. "User switching costs" describe costs to users of ending an affiliation with one mobile platform and starting an affiliation with another. In addition to switching costs associated with learning to use the new platform and with purchasing

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peripherals such as chargers and docks that are device-specific, users face significant app-related switching costs.

21.   One such switching cost is that users will need to determine if their existing apps, especially those that serve or manage critical functions or relationships, are available on the other mobile platform. If the apps are not available, the user may have to spend time researching substitutes, which may be imperfect.

22.   Another switching cost is that, even when the desired apps are available on the new platform, users may need to identify and re-install their apps when they switch platforms. This can be time-consuming (which economists consider costly) if the mobile platforms do not provide a way to do this for many apps at once, because the average user has over 100 apps installed on her mobile device.

23.   Users incur additional costs to transfer their app-related data and reconfigure any customized settings to achieve a comparable experience on the new platform. If users cannot reestablish their relationship with an app developer, they may need to repurchase the app and associated add-on purchases, and somehow transfer (or lose) their app-related data to the new instance of the app on the new platform.

24.   For apps that involve subscriptions, users may have made long-term commitments on their existing platform (*e.g.*, an annual subscription). Users who switch platforms during a subscription period may incur switching costs. Apple requires users to manage their subscriptions, cancellations, and refunds through Apple. Continuing to use some apps on a new platform may require users to repurchase their subscriptions. Because a user may have multiple annual subscriptions that renew at different times, these subscription-related switching costs may be unavoidable.

25.   For all these reasons, users face considerable frictions/costs in moving their apps, purchases, and app data across mobile platforms. These switching costs create what I call an "App Barrier to Switching."

26.   Users also face what I refer to as "mixing-and-matching costs." These describe the costs of accessing apps and services on two or more general-purpose devices (such as smartphones, tablets, laptops, and desktops) with incompatible OSs.

27.   Users typically consume apps and services on several types of general-purpose devices, using them in a complementary manner. A user may own two to three different general-purpose devices.

28.   While these devices are "general-purpose" in that each can carry out varied functions, consumers use different devices in different settings. For example, a user may use her desktop at home during the day, her wi-fi-enabled tablet in bed at night, and her mobile smartphone when commuting to meetings or while also watching TV on the couch.

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29.   Users derive utility from being able to access their apps and services across all their devices and from having their digital purchases and app data (including settings) synchronized across all their devices. For example, users may wish to consume content on all their devices and derive utility from being able to start a piece of content (i.e., a game, book, or movie) on one device and continue on another from where they left off. I call this type of mixing-and-matching "within-user mixing-and-matching."

30.   While many apps interoperate and synchronize across devices with the same OS (or with related OSs), they do not necessarily interoperate and synchronize across devices with different OSs. This reduces the complementarity between the devices and lowers the utility a user derives from her suite of devices. This utility loss reflects the costs of mixing-and-matching.

31.   Mixing-and-matching also takes place among members of a group—what I call "cross-user mixing-and-matching." Members of a group (e.g., a family or business) value being able to share apps across their devices and being able to interact with each other via apps. Certain apps increase in value when they interoperate and synchronize across all devices a family owns. These include parental control apps that allow parents to monitor and set various restrictions on their children's devices; location tracking apps that allow members of a family to track each other; as well as apps that allow families to share purchases or subscriptions. Apple's Family Sharing and Screen Time features, for example, only work if both the parent and the child use iOS or other Apple OSs. If the family mixes-and-matches Android and Apple devices, the value of such apps is reduced, and the Android user must either repurchase the family's apps or not have access to them. This represents a cost of mixing-and-matching.

32.   The inability to mix-and-match across devices with different OSs because of limited interoperability and synchronization of apps and services creates what I call an "App Barrier to Mixing-and-Matching."

33.   The App Barrier to Mixing-and-Matching influences a user's or group's choice of mobile platform. Consider a family of four who might purchase four iPhones, one iPad, and two MacBooks at a total cost of approximately $6,000. If mixing-and-matching across OSs were feasible for a critical mass of the apps and services the family uses, the family could buy two Android phones (about $250 less per phone than the iPhone) and a Kindle Fire tablet (about $240 less than the iPad) for their children, saving approximately $740. If enough apps were interoperable between the parents' and children's devices, cheaper devices may provide sufficient value for the children while saving costs and reducing the risk associated with breakage and loss of the children's devices. While, in theory, the family could also economize by switching all mobile devices to Android, this would require the parents to incur the switching costs outlined above, in addition to the costs associated with lost interoperability with the MacBooks. Thus, the App Barrier to Mixing-and-Matching may deter families from economizing on hardware costs, encouraging OS homogeneity across households—more iOS or Android households, and fewer hybrid households.

34.   The App Barriers to Switching and to Mixing-and-Matching imply that competing platforms—even ones where all a user's existing apps are available—may be perceived as highly

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imperfect substitutes. This reduces competition between the incumbent platforms, iOS and Android. These barriers also exacerbate the difficulty for new platforms to enter and grow.

C.   App Barriers allow mobile platforms to exert market power over users and developers

35.   Because they make switching and mixing platforms more difficult, the App Barriers to Switching and Mixing-and-Matching allow mobile platforms to exert market power over users. When these barriers are high, platforms can increase prices or degrade quality without causing users to switch to the competing mobile platform in sufficient numbers to render such actions unprofitable.

36.   These App Barriers also allow mobile platforms to exert market power over developers. Mobile devices are durable goods that typically cost orders of magnitude more than any single app, and the app-related switching costs I have described are significant relative to the utility loss a user would experience if she loses access to any single app on her device. Therefore, if a developer ceases offering its app on a specific mobile platform, it cannot expect many of its users to switch platforms. Because users' time on mobile devices cannot typically be accessed through other device types—for example, if a user is away from home—if a developer were to leave a mobile platform such as iOS, the developer would likely lose all or most of the revenue associated with iOS users. This allows the platform to exert market power over the developer, for example by raising prices or decreasing quality.

37.   This is exacerbated when an app has direct network effects (i.e., the value of the app for an individual user increases as the number of app users increases). Then, removal of an app from a given platform results not only in the loss of revenue from users of that platform, but also reduces the value of the app to users on platforms where the app is still available. Consider a dating app; should it leave iOS and focus only on Android, the app will not only lose revenue from iOS users, but would also become less valuable to Android users, who would presumably not wish to limit their dating partners to Android users. This latter loss is not internalized by Apple, because Apple is not harmed by the reduction in the value of the app for Android users.

38.   An incumbent platform therefore may exert bargaining leverage over developers, who must transact with the platform to access its users.

D.   Developers incur costs to provide services that would reduce user switching and mixing-and-matching costs

39.   Although developers have incentives to reduce users' switching and mixing-and-matching costs—because lower costs can lead to greater app adoption—reducing these costs requires costly investment by developers.

40.   For example, to facilitate the migration of a user's apps, purchases, and app data across platforms, developers must invest in the infrastructure to offer account management that would recognize a given user across platforms. This entails the fixed cost of developing an account management system and platform-specific implementation costs. The benefit of this

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investment for any individual developer could be small; a single app that reduces switching costs is not enough to induce substantial switching across mobile platforms, and therefore not enough to materially reduce the leverage the platform has vis-à-vis the developer.

41.   Developers therefore face a significant coordination problem: if a critical mass of developers developed cross-platform services, this could shift the balance of power between the platform and developers in a way that would benefit all developers. But on a standalone basis, each individual developer is under-incentivized to invest in these services. A single distributor, acting on behalf of developers, can offer this service to users who need to migrate and synchronize a collection of apps at once.

E.   Mobile platform entrants face barriers to entry and growth due to the App Barrier to Entry

42.   Developers incur costs to develop and maintain an app on any platform. Consequently, developers are often incentivized to initially release their apps on the platform with the largest revenue potential. When considering whether to then release their app on any additional platform, developers consider the incremental profit they would earn—the difference between the incremental revenue they expect to generate from users on the additional platform and the incremental costs they will incur to port the app to and maintain it on that platform. These incremental costs, which I refer to as multi-homing costs, include some duplication of upfront development costs as well as ongoing platform-specific costs to support the app on multiple platforms.

43.   Developers will usually only incur the costs of porting and multi-homing their apps to another platform if the platform has a sufficiently large incremental user base. However, when incumbents exist, users will typically only affiliate with a new platform if the platform has a large enough availability of apps and if it supports the apps the user considers critical.

44.   These dependencies create a chicken-and-egg problem whereby an entrant platform simultaneously requires a supply of apps to attract users and an installed base of users to attract developers. As an example, Microsoft experienced this "App Barrier to Entry" when it tried to launch its Windows Phone—not enough developers would write apps until the phone became popular, but the phone would not become popular with users until there were sufficient apps. Consequently, the phone was discontinued, despite favorable reviews.

45.   It is therefore difficult for an entrant platform to attract users when it could be months or years before users' existing apps become available, if at all. Users would experience a significant utility loss in the intervening period from not being able to access critical services. Additionally, users considering adopting the new platform would face the app-related switching and mixing-and-matching costs described above, further deterring adoption of the new platform.

46.   Because the App Barrier to Entry is difficult for any new entrant to overcome, existing mobile platforms' market power over users and developers is strengthened.

F.   Middleware like multi-platform app stores reduces user app-related switching and mixing-and-matching costs

47.   I use the term "economic middleware," or simply "middleware," to describe technologies whose effect is to alleviate one or more of the following user and developer costs: (1) user applications-related switching costs, (2) user applications-related mixing-and-matching costs, (3) developers' costs of enabling user app migration and synchronization across multiple platforms, which reduce user app-related switching and mixing-and matching costs, and (4) developers' multi-homing costs.

48.   Middleware would reduce Apple's market power over users and developers because, as discussed above, Apple's power derives in part from the costs users incur in switching and mixing-and-matching between platforms and the costs developers incur in multi-homing and in creating the infrastructure necessary to reduce these user costs.

49.   Middleware can take many forms, with the common thread being that it typically enables some functionality across platforms that reduces the user and developer costs referenced above. One such type of middleware is a multi-platform app store, such as Steam, EGS or GameClub, which can offer users a collection of apps that are available to them across platforms. Among other things, these stores streamline the process for users of searching for and installing those apps when switching platforms or using multiple platforms, replacing the need for the user to do this manually, one title at a time.

50.   Multi-platform app stores can incur the fixed costs of creating the infrastructure for developers to offer account management services that can recognize a user's apps, purchases, and app data across platforms, further reducing users' switching and mixing-and-matching costs.

51.   For example, a multi-platform app store can provide cloud storage solutions to backup and synchronize users' progress in a game, allowing users to pick up where they left off on a different platform. Multi-platform app stores can also track users' purchases across multiple platforms, allowing them to purchase an app once and use it seamlessly on all platforms that support the store—whether the app is a paid app or one that offers in-app purchases and subscriptions.

52.   In a world where multi-platform app stores are permitted, they would compete with Apple's App Store and each other to remove as many frictions for users as possible. Users do not benefit from frictions to switching.

G.   Middleware can reduce porting and multi-homing costs for developers

53.   Existing multi-platform app stores like Steam and EGS, which operate across Windows and MacOS platforms (and in Steam's case, Linux as well), invest in infrastructure, such as free APIs, that reduce the cost to developers of developing, publishing, and porting their games across the supported OS platforms (the multi-homing costs). For example, Steam and EGS allow developers to set up a single account, manage a single distribution relationship, go through a single app review process, manage their customer base, submit updates

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simultaneously, and market apps across all supported platforms. This, in turn, lowers user switching and mixing-and-matching costs because users can access their library of games across all their supported devices without having to create new accounts, enter new payment credentials, or re-purchase games or game content. Specifically, Steam and EGS provide users with a "library" wherein they can store and access their apps and purchased content, no matter what supported device they are using.

54.   Further, by reducing multi-homing costs for developers related to store functions, a multi-platform app store would help to address the chicken-and-egg problem I described previously. Specifically, it would lower the cost for developers to make their apps available on a new mobile platform the multi-platform app store chooses to support, and simultaneously reduce the costs to users of switching to the new platform since their apps will be made available seamlessly on the new platform. By providing these services for a critical mass of apps simultaneously, a multi-platform app store would thus enable easier entry or growth by a nascent mobile platform.

V.   Apple Imposes a Set of Restrictions that Block Important Forms of Middleware and Thereby Protect its Market Power Over iOS Users and Developers

55.   Apple imposes a set of technical and contractual restrictions that block the emergence of middleware. Indeed, despite recognizing the customer demand for features that enable interoperability of apps and user data across devices *within* the Apple ecosystem (*e.g.*, iPhones, iPads, Macs, Apple Watches), Apple has implemented targeted restrictions to make it substantially more difficult, and in most cases impossible, for third-party middleware like multi-platform app stores and app-streaming services to gain a foothold.

56.   By blocking middleware, Apple's restrictions (1) increase app-related switching and mixing-and-matching costs for users; (2) limit technologies that would reduce these costs; (3) maintain developer porting and multi-homing costs to entrant platforms, reinforcing the chicken-and-egg problem; and (4) discourage nascent competitive threats that could emerge from the middleware itself. Because switching costs are already high for users who are locked-in to either Android or iOS, Apple's restrictions on app distribution and in-app purchases therefore are harmful to users and developers and maintain Apple's market power over iOS platform users and developers.

A.   Apple excludes multi-platform app stores and restricts apps from offering features that are part of multi-platform app stores

57.   Apple makes it impossible for multi-platform app stores to operate on iOS in myriad ways.

58.   Most obviously, Apple excludes all competing app stores from iOS by prohibiting developers from using any distribution channel except the App Store to distribute iOS apps, and by blocking all competing stores from being distributed on iOS. *See* Apple Developer Program License Agreement §§ 3.2(g), 7.6 (PX2481) (PX2619).

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59.   Apple likewise prohibits apps on iOS that could install additional executable code, including specifically any app that would create a store or storefront for other apps, effectively prohibiting multi-platform app stores from operating on iOS. *See* Apple Developer Program License Agreement §§ 3.3.2 ~~(PX2481)~~ (PX2619).

60.   As described in more detail in Section V.D of my testimony below, Apple prohibits developers from using their own or third-party payment processing systems, instead forcing them to use Apple's proprietary system. Only Apple may then issue refunds to end-users of the developers' iOS apps (*see* Apple Developer Program License Agreement § 3.4 ~~(PX2481)~~ (PX2619)), effectively making it impossible for developers to provide customer service to their own users, including with respect to cross-platform issues like duplicate purchases and other billing-related matters.

61.   Apple also restricts developers from creating an interface for displaying third-party apps similar to the App Store. According to Apple's App Review Guidelines, apps also cannot merely provide a catalog of a developer's apps, or act as a mere storefront. Apps can only display a collection of other apps if those apps are all designed for a specific approved need (*e.g.*, health management, aviation, accessibility). Apple also requires that apps displaying a collection provide editorial content, so that the app does not look like a storefront. *See* Apple App Review Guidelines §§ 3.2.1, 3.2.2 (PX56). For example, EGS is a digital storefront through which users can purchase and download various apps such as Fortnite or Spotify. EGS is not allowed to operate on iOS, but is available on Mac computers, where these restrictions do not apply.

62.   Apple also restricts developers from offering subscriptions that provide access to other apps that are not all owned or exclusively licensed by the developer. In other words, developers can only offer collections of apps they have developed or exclusively licensed . Eliminating this restriction would not impose any technical costs on Apple. *See* Apple App Review Guidelines §§ 3.1.2(a) (PX56).

B.   Apple itself has recognized the value of easily migrating and synchronizing users' apps, purchases, and app data across devices

63.   Apple clearly recognizes the value proposition of cross-platform compatibility. Apple, on the one hand, provides such compatibility across Apple platforms, while on the other hand, actively impedes such compatibility between Apple platforms and non-Apple platforms. In this way, Apple raises users' switching and mixing-and-matching costs.

64.   Apple created an "ecosystem" made up of multiple devices—smartphones, tablets, personal computers, watches, streaming devices and more. Apple invested heavily in making these devices work seamlessly with each other by supporting cross-device Apple services such as iMessage and Face Time, and providing users with the ability to begin a task (such as a phone call or a web-browsing session) on one device and then pick it up on another.

65.   Moreover, Apple provides easy migration and synchronization of users' apps, purchases, and app data across Apple devices. For example, Apple offers its iCloud service,

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which allows users to access, synchronize and update their data, including photos, videos, apps, and other content, across their Apple devices, like iPhones, iPads, and Mac computers.

66.   Apple's App Review Guidelines encourage developers to "consider building universal apps so customers can use them on all of their [Apple] devices." *See* Apple App Review Guidelines §§ 2.4.1 (PX56). Moreover, developers who offer subscriptions that work on multiple Apple devices must allow the subscription to work across all such Apple devices for a single price. *See* Apple App Review Guidelines §§ 3.1.2 (PX56).

C.   Examples of existing multi-platform app stores demonstrate the competitive impact of Apple's restrictions

67.   Existing multi-platform app stores Steam, EGS and GameClub demonstrate how multi-platform app stores can generate the middleware effects that decrease an incumbent platform's market power and how Apple's restrictions block the emergence of multi-platform app stores on iOS.

68.   Steam is a specialized multi-platform app store that distributes games, graphics, photo editing, utilities and other apps to Windows, macOS, and Linux users. Steam allows users to create one Steam account to use across platforms and to access games they purchased on Steam on any platform on which the app is supported. Users can store their purchased content in their "Steam Library," store their payment methods in their "Steam Wallet," chat and text with other users in real-time with "Steam Chat," and synchronize apps and data through a cloud storage solution, "Steam Cloud," all of which are accessible across platforms. By enabling users to access games and purchased game content on, for example, their Mac desktop and Windows laptop, Steam reduces users' switching and mixing-and-matching costs.

69.   For developers, Steam offers "Steamworks," or Steam APIs, which they can use to develop and publish games that are compatible across platforms. Steam provides developers with the functionality to verify users' identity and ownership of a game, store game and user-level data in the cloud, protect against piracy ("Steam DRM"), host dedicated servers for games, and translate their games to different OSs.

70.   EGS is a specialized multi-platform app store that operates across Windows and macOS. EGS reduces switching and mixing-and-matching costs because users can use a single login, store their apps and purchases in the EGS Library and have access to those apps across compatible platforms. Thus, the features provided by EGS enable users to mix-and-match devices or switch to a new platform and have immediate and seamless access to all their EGS apps, purchases, and app data (subject to the availability of each game on both platforms).

71.   EGS also provides tools that enable developers to migrate user data across devices and platforms and grants developers access to EGS's "Ecom Interface," which allows the developer to offer in-app purchases and in-app currency across supported platforms through EGS.

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72. Apple's restrictions on iOS exclude multi-platform app stores like Steam and EGS.

73. Apple also severely restricts the offering of GameClub, a store-like cross-platform subscription service offering a collection of more than 100 paid games.

74. GameClub allows users to sign up once, through a single login, and create a family-sharing account that is compatible across platforms and can be used on up to 12 devices. For developers, GameClub allows offering cross-platform functionality, invests in infrastructure allowing developers to port games from iOS to Android, and allows the sale of a bundle of games as part of a subscription.

75. GameClub launched on iOS in 2019 (after 127 rejections from the App Store), but its ability to function as a multi-platform app store has been limited by Apple's restrictions, specifically its prohibition on creating a storefront and requirement that a developer can only offer its own apps for sale. To deal with the restriction, GameClub had to acquire or exclusively license every one of the apps it supports, artificially impeding GameClub's growth. GameClub competes head-to-head with Apple's own Arcade game subscription service, which is not subject to the same limitations and that Apple features heavily on the App Store, including in an Arcade-specific tab. In addition, like any iOS developer, GameClub is subject to Apple's requirement that its subscription use Apple's payment processing service and pay Apple's commission.

D.   Apple restricts in-app payment systems, an important form of middleware

76. Another form of middleware that Apple restricts is in-app purchase systems. Apple's requirement that apps exclusively use Apple's own IAP system for in-app purchases of digital goods increases user switching and mixing-and matching costs and makes it more difficult for developers to offer cross-platform services to users that would reduce these costs.

77. Migration and synchronization of in-app purchases of subscriptions and non-consumable in-app purchases (for example, buying a bonus game level) is more difficult with Apple's IAP than it would be with a payment processing service that operates across iOS and non-Apple platforms. Developers cannot enable users to manage their in-app purchases and subscriptions in their apps; rather, users must manage all cancellations, refunds, and subscriptions through Apple, which makes migrating and synchronizing purchases difficult for a user who wants to switch or mix-and-match.

78. For users, a multi-platform in-app payment system would reduce these switching and mixing-and-matching costs by recognizing user purchase histories across multiple platforms, allowing them to migrate and synchronize subscriptions, consumable in-app purchases, and non-consumable in-app purchases, allowing users to store payment methods and preferences, enabling family sharing, and more. For developers, a multi-platform in-app payment system would enable more effective customer support to iOS users who have switched or mixed-and-matched devices.

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79.   Apple excludes multi-platform in-app payment systems by requiring developers to use Apple's own IAP. With few exceptions, developers who offer apps that feature in-app purchases of digital content must offer on iOS any content they make available for sale within the app on another platform, and must use IAP to do so. Therefore, multi-platform apps *must* use IAP on iOS and a different system on Android.

80.   Additionally, developers cannot direct users out of their app to alternative payment processors of any kind, *i.e.*, linking to another payment mechanism, describing within the iOS app how to access these options on another platform, or contacting iOS users through the account information they provide within the iOS app to direct them to alternative payment options. For example, Spotify claims that its app was rejected from the App Store for including an external link to a page containing product information, discounts, and promotions.

81.   Amazon's Kindle, a cross-platform reading app, demonstrates how a multi-platform in-app payment system reduces user switching and user mixing-and-matching costs. When Amazon introduced seamless cross-platform usage of the Kindle app, Apple recognized that this type of switching would increase competition and threaten its market power. In response, Apple added restrictions disallowing apps linking to external mechanisms for purchasing in-app content. Kindle then removed information on how to purchase an e-book via its website and removed all links to those websites, ultimately deciding not to use IAP as its payment processing solution in Kindle on iOS. The result is that iOS Kindle users cannot purchase Kindle books within the iOS app at all and are forced to figure out how to obtain such content outside the app on their own. That level of friction may well be unacceptable to apps that are less established than the Kindle, and that rely on smaller and more frequent transactions (such as repeated in-app microtransactions of $0.99). And moreover, while Kindle decided not to use IAP, Apple does not allow most other apps selling digital goods to make this choice; it requires most other apps that offer digital goods for sale on other platforms to also offer them for sale on iOS, using IAP.

E.   Apple restricts app streaming platforms, a promising type of middleware

82.   Apple also restricts streaming platforms for apps, another type of middleware. Streaming refers to distributing interactive media to electronic devices via the internet in real time. Netflix, a video streaming service, and Spotify, a music streaming service, demonstrate the potential of streaming platforms for apps. For users, streaming works across platforms and devices and a user's streamed apps are tied to a single account, thus reducing switching and mixing-and-matching costs. Because streamed apps could be accessed on many platforms, they facilitate mixing-and-matching and switching.

83.   Streaming platforms can go beyond video or music content. For example, the technology is now emerging that would allow interactive games to be provided through a streaming platform; game action is streamed as video from a cloud server, and users' actions are relayed back to the cloud.

84.   For developers, a middleware streaming platform reduces porting and multi-homing costs because they need only build their apps to a single cloud platform. A streaming

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platform could potentially act as a form of multi-platform app store by connecting users to a catalog of cloud-based apps and updates. For example, users potentially could access many different streamed apps using a single, optimized app on their device, where the streamed apps run in the cloud. Similar to the convenience that Netflix and Spotify bring to users in consuming video and music, a streaming platform for apps could potentially allow users to seamlessly switch between streamed apps through a single app.

85.   Based on the same restrictions I discussed earlier, Apple prohibits a streaming service from resembling a store-like interface. Apple therefore only allows streaming if users download each streamed app directly from the App Store, which unnecessarily increases friction for users and impedes the growth of streaming platforms. Apple has used these restrictions to prevent existing streaming services like Microsoft xCloud, Google Stadia, and Nvidia GeForce Now from being distributed through the App Store. Eliminating these restrictions would not impose additional technical costs on Apple, since the streaming app is simply an app like any other.

VI.   Documents Recently De-Designated by Apple Reinforce My Opinions

86.   When formulating my opinions, I could not consult confidential Apple documents, pursuant to the Protective Order in this matter, because I previously worked for a company that competes with Apple. After the submission of my report, however, I reviewed certain Apple documents for which Apple has recently withdrawn its prior confidentiality designations.

87.   While I did not rely on these documents to form my opinions, these Apple documents are consistent with and reinforce my opinions. These documents establish Apple's keen awareness of the economic principles I have articulated in my testimony and demonstrate Apple's concerted efforts to take advantage of these economic realities to maintain its market position.

88.   As an example, Apple clearly is aware that switching and mixing-and-matching costs effectively lock users into the iOS ecosystem, and Apple has sought to maintain and enhance those impediments to competition.

89.   In 2010, Steve Jobs identified as one of Apple's goals for the following year to "tie all of our products together" and "make [the] Apple ecosystem even more sticky." (PX892.2) In a 2013 email, Apple executive Eddy Cue explicitly articulated the kinds of switching costs about which I have testified:

> "Getting customers using our stores (iTunes, App and iBookstore) is one of the best things we can do to get people hooked to the ecosystem. The more people use our stores the more likely they are to buy additional Apple products and upgrade to the latest versions. Who's going to buy a Samsung phone if they have apps, movies, etc already purchased? They now need to spend hundreds more to get to where they are today." (PX405.1-405.2.)

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90.   In another 2013 email, Apple executive Craig Federighi encapsulated the concept of mixing-and-matching costs in the context of a debate about whether Apple should make its proprietary iMessage service available on Android, stating: "I am concerned the iMessage on Android would simply serve to remove [an] obstacle to iPhone families giving their kids Android phones." (PX407.1.)

91.   Similarly, in 2016, a former Apple executive wrote an email to his colleagues at Apple about his experiences using an Android phone, noting, among other things:

> "And the #1 most difficult to leave the Apple universe app is iMessage. Moving to Android my family was forced to move to Facebook to message me, I used WeChat, WhatsApp and Slack for work, but I missed a ton of messages from friends and family who all use iMessage and kept messaging me at my old address. iMessage amounts to serious lock-in." (PX416.3.)

92.   Apple executive Phil Schiller ultimately forwarded the email to Apple CEO Tim Cook, writing: "I think moving iMessage to Android will hurt us more than help us, this email illustrates why." (PX416.1.)

93.   The documents I reviewed likewise illustrate Apple's awareness of the role middleware could play in undermining its dominance in iOS app distribution. In one example, Apple executive Scott Forstall emailed Phil Schiller about Yahoo's desire to build its widget engine on the iPhone as a "cross-platform way to build widgets." (PX882.1.) Forstall noted that he was "not sure we shouldn't take the high ground and let them build it and compete." (*Id.*) Schiller responded that he thought that was a "horrible idea" and noted the potential impact on Apple's dominance:

> "There are many APIs out there for apps. By the same logic why not let Sun have Java on the iPhone? Why not Adobe's Air? Why not Microsoft's Silverlight? Why not Qualcomm's Brew? etc etc
>
> With one API (ours) we can manage what is on our products and what is not. If we open it up then we don't sign all apps, we don't distribute all apps, etc. Which is the same as throwing out the whole plan we have in place. . . . Besides, we have a way to do Widgets that competes with theirs, so who cares?" (*Id.*)

94.   Schiller echoed the same "plan" to maintain Apple's dominance in a 2011 email chain with Forstall and Steve Jobs regarding Facebook's desire to provide links from its app to certain web apps that run on general purpose web browsers accessible across platforms, as opposed to natively within iOS. Concerned that allowing Facebook to do so would unleash the ability of other companies to hasten the development of this type of middleware, Schiller wrote:

> "So, for example [if] Adobe comes in with an app that links to new web apps that they promote we need to allow that 'app store' in,

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even worse Google could come up with an app that runs all their
3rd party Chrome web apps and we would need to allow that in
too! I don't see why we want to do that. All these apps won't be
native, they won't have a relationship or license with us, we won't
review them, they won't use our APIs or tools, they won't use our
stores, etc. Maybe this is inevitable and there are going to be many
Safari based HTML 5 apps . . . [b]ut this is a big deal and
FaceBook will accelerate the move to these web apps."
(PX886.2.)

95.   Finally, the Apple documents I reviewed provide additional examples of Apple's
concerted efforts to impede the development of middleware. In 2011 and again in 2013, Apple
rejected from the App Store game subscription apps from a developer called Big Fish. (PX114;
PX115.) As Apple executive Phillip Shoemaker described it, "Big Fish Unlimited is seen as a
game store within an app. This is not allowed. Phil [Schiller] and Eddy [Cue] have been
adamant about this, despite my protests." (PX115.1.) However, when asked by a colleague why
Apple would not publicly explain the basis for the rejection of Big Fish's game subscription app,
Shoemaker responded, "Because [it's] chicken shit. We don't have a guideline for this."
(PX114.1; *see also* PX115.)

96.   Due to the requirements of the Protective Order, my opinions were predicated on
well-established economic principles and Apple's public conduct consistent with those
principles. My review of Apple's recently de-designated documents establishes that Apple's
conduct was not merely consistent with the anticompetitive incentives I had identified, but often
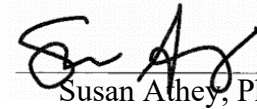driven by them. These documents therefore strengthen my opinions.

VII.   Conclusion

97.   If it were not impeded by Apple's restrictions, middleware such as a multi-
platform app store could meaningfully reduce user switching and mixing-and-matching costs,
facilitate developer cross-platform support for users' switching and mixing-and-matching, and
reduce developer multi-homing costs.

98.   In turn, these effects could: (1) mitigate Apple's market power over users and
developers, (2) increase competition among mobile platforms on both quality and price, and (3)
increase the chance that mobile platform competitors could enter and/or gain traction (e.g.,
enable nascent competitive threats). As a result of increased competition, we would expect
greater innovation in middleware, including competition among middleware providers to reduce
frictions for users and developers. The benefits of these innovations would accrue to participants
both inside and outside of Apple's platform.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct and that I executed this written direct testimony on April 20, 2021, in Stanford, CA.

WORD COUNT: 7,468

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Susan Athey, Ph.D.